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Title: System And Method For Curing Reactive Material

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**Title: SYSTEM AND METHOD FOR CURING REACTIVE MATERIAL****FIELD OF THE INVENTION**

- 10 [0001] The present invention relates generally to the field of curing polymeric materials, with common but by no means exclusive application to manufacturing techniques for the joining of fibre optic cables using reactive adhesives. For greater clarity, when used herein, reference to "curable" and "reactive" materials and variations thereof is intended to mean polymeric
- 15 materials which chemically transform with the application of sufficient energy, unless a contrary intention is apparent.

**BACKGROUND OF THE INVENTION**

- 20 [0002] Fiber optic cabling is used extensively in high-speed communications networks. However, given the necessity of maintaining maximum optical transmission, coating and joining or "splicing" segments of fiber optic cabling to repair or extend the cabling, can prove difficult.
- 25 [0003] Accordingly, the inventors have recognized a need for a system and method which are capable of efficiently coating and joining segments of fiber optic cabling.

30 **SUMMARY OF THE INVENTION**

[0004] This invention is directed towards a system for curing reactive material.

- [0005] The system includes an inlet port adapted to receive radiation
- 35 from a source, a plurality of emitter ports and transmission means operatively coupling the inlet port to each emitter port. The transmission means is

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5 adapted to conduct radiation from the inlet port to the emitter ports. The transmission means preferably includes a plurality of optical fibre strands. Additionally, the system also preferably includes a housing defining a substantially tubular irradiation chamber.

10 **[0006]** In another aspect, the invention is also directed towards a system for curing reactive material. The system includes an inlet port adapted to receive radiation from a source, at least one emitter port, and transmission means operatively coupling the inlet port to each emitter port. The transmission means is adapted to conduct radiation from the inlet port to the  
15 emitter ports. Preferably, the emitter port is configured in a shape approximating the surface area of a portion of a workpiece to be cured.

**[0007]** The invention is further directed towards a method for joining a first optical cable having an end to a second optical cable having an end. The  
20 method includes the steps of:

- (a) abutting the end of the first optical cable to the end of the second optical cable;
- (b) applying reactive adhesive to the abutted ends; and
- 25 (c) directing radiation within the absorption spectrum of the reactive adhesive onto the adhesive until the adhesive is sufficiently cured.

**[0008]** Preferably, step (c) involves positioning the abutted ends within  
30 the irradiation chamber of the curing system of the present invention.

**[0009]** The invention is yet further directed towards a method for coating fibre optic cabling. The method includes the steps of:

- (a) applying reactive coating material to the outside of the fibre optic  
35 cabling ; and

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**[0010]** Preferably, step (b) involves positioning the coated fibre optic  
10 cabling within the irradiation chamber of the curing system of the present  
invention.

15   **[0011]**       The present invention will now be described, by way of example only, with reference to the following drawings, in which like reference numerals refer to like parts and in which:

**[0013]** FIGURE 1B is an expanded view of the input port of the curing system of Figure 1A.

25 **[0014]** FIGURE 2 is a cross-sectional view of the curing system of Figure 1A with the optical fibre filaments removed.

**[0015]** FIGURE 3 is an expanded view of an emitter port of the curing system of Figure 1A.

**[0016]** FIGURE 4 is a top perspective view of a second embodiment of the curing system made in accordance with the present invention.

**[0017]** FIGURE 5 is a logical flow diagram of a first curing method  
35 carried out by the curing system made in accordance with the present  
invention.

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**[0018]** FIGURE 6 is a logical flow diagram of a second curing method carried out by the curing system made in accordance with the present invention.

10 **DESCRIPTION OF THE PREFERRED EMBODIMENTS**

**[0019]** Referring simultaneously to Figures 1A and 1B, illustrated therein is a first embodiment of the curing system of the subject invention. The curing system, shown generally as 10, includes a housing 12, an inlet port 14 and an irradiation chamber 16.

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**[0020]** The housing 12 is typically made of metal or other material selected to be largely unaffected by the heat generated by the curing process. The housing 12 is generally cylindrical; however, as will be understood, alternate configurations of the housing 12 may be used depending on the requirements of the curing application.

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**[0021]** As illustrated in Figure 1B, optical fibre filaments 18, typically approximately 245 micrometers in diameter are compressed in the mouth of the inlet port 14 and adhered together. The ends of the filaments 18 are ground and polished smooth to maximize optical transmission from a radiation source (typically a standard light guide). The inlet port 14 is generally circular in shape, and preferably configured to mate with the metal ferrule of a standard light guide, using a coupler, as will be understood. Preferably the fibre filaments 18 are made of quartz or other standard optical fibre material, adapted to receive and transmit radiation suitable for curing reactive materials.

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**[0022]** Referring now to Figures 2 and 3, the housing 12 defines an irradiation chamber 16 which is generally tubular about a central axis 20, and circular in cross-section. Preferably the irradiation chamber 16 is sized to receive a standard fibre optic bundle for curing. Standard fibre optic bundles

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- 5 are typically 3, 5 or 8 mm in diameter. Eight emitter ports 22 are positioned on the interior wall 24 of the irradiation chamber 16, evenly spaced in a circle about the central axis.

- [0023]** The emitter ports 22 are adapted to direct radiation radially  
10 towards the central axis 20. Preferably the emitter ports 22 are shaped and positioned on the interior wall 24 in order to provide irradiation generally in a 360° arc around the central axis 20, to ensure even distribution of curing radiation about the object to be cured. Each emitter port 22 is substantially rectangular in shape, with the width of the port 22 sufficiently small in relation  
15 to the length that the port 22 is substantially linear in appearance.

- [0024]** The second end of each emitter fibre 18 terminates at an emitter  
port 22, where it is compressed into the shape of the emitter port 22 and  
adhered to the other fibres 18 at that emitter port 22. As with the inlet port 14,  
20 the ends of the fibres 18 are ground and polished smooth to maximize optical transmission. The optical fibres 18 function to transmit radiation received from a radiation source at the inlet port 14 to the emitter ports 22.

- [0025]** Since the radiation source may not provide radiation uniformly  
25 into the inlet port 14, it is preferable if the second ends of the optical fibre filaments 18 are randomly distributed between the various emitter ports 22, once the first ends are positioned at the inlet port 14. Random distribution of the fibre filaments 18 will help ensure that the radiation emitted by the various emitter ports 22 is substantially uniform, as will be understood. The eight  
30 bundles of optical fibre filaments 18 corresponding to each emitter port 22 are housed within the housing 12, and are illustrated schematically as dotted lines on Figure 1A.

- [0026]** Illustrated in Figure 4 is a second embodiment of the curing  
35 system of the subject invention. The second embodiment, shown generally as 110, includes a housing 112, a first inlet port 114, a second inlet port 115 and an irradiation chamber 116.

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5   **[0030]**       Figure 6 illustrates the steps of the method 300 carried out by  
the curing system 10, 110 in use and made in accordance with the subject  
invention. The user typically first coats the external surface of fibre optic  
cabling with reactive coating material. (Block 302) The coated cabling is then  
positioned within the irradiation chamber. (Block 304) Radiation is then  
10   directed into the inlet port(s) and transmitted out the emitter ports until the  
coating is sufficiently cured. (Block 306) As will be understood, the coating  
and curing steps may be carried out as a continuous process with the cabling  
advancing at a steady rate through a coating apparatus, and through the  
irradiation chamber.

15               **[0031]**       As will be understood, while the irradiation chambers 16, 116  
have been disclosed as being tubular and circular in cross-section, it should  
be understood that different configurations are possible, including for curing  
applications other than the joining of fiber optic cables using reactive  
20   adhesive. Additionally, while the two embodiments 10, 110 have been  
illustrated as having eight evenly spaced emitter ports in their irradiation  
chambers, it should be understood that other numbers and configurations of  
emitter ports are possible, as long as sufficient radiation is directed onto the  
object to be cured.

25               **[0032]**       Thus, while what is shown and described herein constitute  
preferred embodiments of the subject invention, it should be understood that  
various changes can be made without departing from the subject invention,  
the scope of which is defined in the appended claims.

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